

contrasted to the first power field for the idealized heterodyne quantum noise limited case. The overall effect is to place far more stringent requirements on the type of laser source used than would be otherwise. The magnitude of this problem is illustrated in a simple case to show how much reduction may occur in performance. Laser sources other than the currently used laser diodes may alleviate the problem to a considerable degree with some reduction in performance due to the more limited frequency sweep.

In conclusion, it may be said that the FM-CW laser radar concept has already demonstrated considerable capability, and that limitations on performance stem from characteristics of laser sources which are constantly improving. Given this trend, it seems apparent that the FM-CW laser radar will clearly represent a considerable competitor for the time-of-flight technique and its close cousin, the tone modulated method.

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### **Demonstration of Automated Proximity and Docking Technologies**

By Robert Anderson, Roy Tsugawa/TRW and  
Thomas Bryan, MSFC

146684

An autodock was demonstrated using straightforward techniques and real sensor hardware. A simulation testbed was established and validated. P-1

The sensor design was refined with improved optical performance and image processing noise mitigation techniques, and is ready for production from off-the-shelf components.

The autonomous spacecraft architecture is defined. The areas of sensors, docking hardware, propulsion, and avionics are included in the design. The Guidance Navigation and Control architecture and requirements are developed. Modular structures suitable for automated control are used.

The spacecraft system manager functions including configuration, resource and redundancy management are defined. The requirements for autonomous spacecraft executive are defined. High level decisionmaking, mission planning, and mission contingency recovery are a part of this. The next step is to do flight demonstrations.

After the presentation the following question was asked. How do you define validation? There are two components to validation definition: software simulation with formal and vigorous validation, and hardware and facility performance validated with respect to software already validated against analytical profile.